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Date	March 2017
Key stages	KS1 and KS2
School type	LA maintained, primary
Themes	Mathematics

Can we ensure that home learning consistently supports a growth mindset in maths for all children?

St Margaret Clitherow RC Primary School

Context

St Margaret Clitherow RC Primary School is an average-sized primary school located in Stevenage. The school was rated as 'outstanding' by Ofsted in March 2013.

The focus

On Friday 18th September 2015, the Herts for Learning maths team hosted a national conference with Jo Boaler, Professor of Mathematics at Stanford University, as the key note speaker. Many Hertfordshire teachers attended the conference to find out more about developing mathematical mindsets and were inspired to continue improving opportunities in mathematics for their pupils through an action research project. The purpose of the project was to explore some of the themes covered by Jo Boaler and research different ways of developing mathematical mindsets. ***This case study has been written by Karen Briscoe, Maths Subject Leader and member of the Senior Leadership Team.***

Following the conference, we were concerned that having invested heavily in developing a growth mindset in our children they would be subjected to different messages and influences at home. How were we going to educate our parents about the need for positivity towards maths and the notion that mistakes can be a positive thing? We started to explore whether parental barriers to maths impacted on our pupils' attitude toward the subject.

During the conference Stanford University Professor, Jo Boaler, highlighted concerns about maths homework and the messages children receive at home. Was the work being done in school to develop a growth mindset in our children being undermined at home? Does our homework support our 'Building Learning Power' (BLP) principles?

Our school has developed a Building Learning Power approach to teaching and learning, based on the research of Professor Guy Claxton, in order to get positive outcomes for our children. We believe that this approach enables us to build children's confidence, independence and appetite for learning. The question for us was whether or not this confidence is transferred to homework or does parental anxiety influence our pupils when they are at home? "If the children have to ask you every time they want to use the dictionary, you are missing an opportunity for them to develop their own resourcefulness. If you rescue them the minute they meet difficulty or frustration, you are depriving them of opportunities to strengthen their resilience. If you always tell them exactly what equipment they are going to need to do an experiment, you are training them to become dependent and mindless; you are thinking for them, not creating opportunities for them to learn how to think for themselves" (Guy Claxton).

Herts for Learning

Jo Boaler has proven the connection between struggle and brain growth. She has used the growth mind-set approach with hundreds of maths teachers, encouraging them to celebrate mistakes and recognise that to struggle is valuable. We have worked hard in school to develop this resilience in our children. To help them to understand that, "getting it wrong is the start of getting it right," and that there is no such thing as a, "maths brain."
This belief that you can learn anything if you're willing to try, persevere and attempt different approaches is a characteristic of a growth mind-set – the antidote to maths anxiety. According to Sian Beilock, Professor of Psychology at the University of Chicago, "for someone who has math anxiety, the anticipation of doing math prompts a similar brain reaction as when they experience pain." We wanted to be sure that our pupils have opportunities to apply the characteristics of a growth mindset when learning at home."

Description of my approach

At the beginning of the project, it was important to get the views of parents and pupils. On Parents' Evening we collected parents' views about how they felt about maths homework. We displayed a series of questions and asked parents to post questions, ideas and concerns on sticky notes. This enabled parents to respond quickly. The evening was chosen as an ideal opportunity as parents were talking about maths with their child's teacher and looking at maths books.

The response indicated a strong emphasis on more collaborative, problem solving, fun and creative maths. The parents felt that more extended pieces of work would be desirable with many requests for weekend homework as the week is so busy. Parents requested more information about suitable online materials like the "Mathletics" resources currently used. Another strong message from parents was that they want to know what is going on more frequently. Parents were concerned that they did not have knowledge of content and method.

Many of the parent requests and concerns were ones we felt we could do something about immediately. We decided that we could tackle parental requests quickly through improvements to our website. This would enable parents to be able to refer to resources as and when the need arises. Our response to requests for more information about content and method was to develop a MATHSZONE on the website. The MATHSZONE will include a glossary of important vocabulary, ideas for topics that parents can try at home, links to other online resources and pupil and teacher generated content. As the resource develops we will include video and PowerPoint examples of methods. We developed class blogs to give a weekly insight into the maths going on in classes. Advice is available on the website along with explanations of the characteristics of learning.

In the past we have held parents' meetings to explain the principles of Building Learning Power and how we use this approach in school. These will be extended with a particular focus on maths in the Autumn Term.

At the beginning of the project, we asked the children for their views on homework through the use of a questionnaire. Our findings showed that our children are resilient when faced with different opinions at home. We found that, rather than children being concerned about getting things right in maths and being susceptible to maths anxiety when working on homework, in fact, they have learned systems within school which make them highly resourceful when faced with difficulties at home. What was clear, however, was that we needed to develop the language of BLP to enable parents and children to really understand the characteristics of learning that the homework was designed to support.

The questionnaires indicated that most pupils (90%) enjoy maths homework and find it interesting and varied. Their favourite work involves the use of online materials such as "Mathletics". Most children (77%) said they really enjoy learning times tables with the challenge of '50 Club' figuring high on their list of achievements.

We considered how to ensure that in homework tasks children would be able to develop the characteristics of learning.

We started to include more discussion and clarity about the characteristics of learning in lessons and as part of our homework tasks. Homework was renamed 'Home Learning' and children were encouraged to evaluate the process alongside the tasks. We reinforced the vocabulary around the characteristics of learning and made this explicit in the introduction to and evaluation of learning.

REFLECTIVENESS	RESILIENCE	RESOURCEFULNESS	RECIPROCITY
Planning Understanding Revising Revisiting Practising	Absorbing Managing distractions Noticing Persevering	Questioning Making links Imagining Reasoning Finding out	Interdependence Collaboration Empathy Listening Imitation

At the end of the project, interviews with groups of pupils were carried out by myself and our School Improvement Partner. Pupil interviews were held with a mixed gender and ability group from each class. The children enjoyed talking about their maths, they were animated and excited when they spoke about the "excitement" and "challenge" maths can bring.

The interview questions focused on learning in maths, the impact of marking and feedback, growth mindsets and resilience. Our key outcomes were that our pupils enjoy different ways of working. They enjoy working with a partner as they can show each other different strategies. Many pupils recognise that speed is important when they are under time pressure but one pupil commented, "maths has its own pace."

It was very clear from pupil responses that they enjoy extra challenges. They particularly enjoy new learning and getting things right that they did not get right before. Our pupils are independent learners, when stuck in school they use a good range of strategies such as; ask a friend, then a Teaching Assistant (TA) and then a teacher. They use the supportive learning environment which includes a range of displays, resources and learning prompts.

The pupils understand the school's marking and feedback system. They enjoy praise and are motivated by the house points and sticker incentive systems. They persevere if they get something wrong. Teachers sometimes use short notes of advice next to a question in the pupils' books and they are given time to act on this advice. The pupils also enjoy 1:1 feedback from their teachers. They have opportunities for peer-evaluation but felt that they had more opportunities to do this in English than in maths. When asked what they do if they find it hard to move on with homework, the pupils confidently shared a range of self-help strategies such as; write a note to the teacher, have a go or by putting a star next to a question. When "stuck" at home the pupils are supported by family members including older siblings. "I ask my brother because he is in Year 9 and is still in learning." Some pupils use the internet to seek guidance. When asked about "Building Learning Power" and how this helps their learning the pupils mentioned the different characters "I am like Rhino and I never give up."

In Year 5, the pupils evaluate their BLP on a weekly basis. In this year group, the school is trialling a system of children giving weekly learning feedback to their parents / carers via a diary which includes some test results as well as pupils' evaluations of what they have enjoyed and aspects they have found challenging. This system has been introduced following parental feedback. Initial parental response has been very positive. Parents / carers say that this strategy supports them in initiating conversations about learning with their children. They consider the characteristics they have shown throughout their lessons during the week and think about what their next steps need to be.

Interviews with younger pupils showed that they enjoy challenges which make them work really hard such as the '50 club' which focuses on tables and mental fluency. The pupils are very clear that, "getting it wrong is the start of getting it right." They use a range of manipulatives to support their learning. When the pupils were asked about BLP they talked about the learning behaviours represented by the different animals. "We use tortoise when we need to stop and think." "Be like rhino, keep trying and be resilient." "I can be like hare and have a go."

The pupils enjoy working with a partner or in a group because, "when you are stuck you can ask a partner and work together on a problem." The pupils feel successful when they have tried hard, when they get answers wrong or right and when they know what to work on to get better.

If our pupils are stuck at home they use a range of strategies. They seek help from family members, some use a calculator or an iPad. One pupil suggested that sometimes it's good to take a five minute break and run around outside then come back to it feeling more focused. The pupils would like fewer but more challenging homework tasks.

Work indicates that BLP principles are so well embedded that pupils' resilience and their "have a go" attitude thrive even when there is a parental barrier to maths. Pupils are willing to try, even without parental support and will approach their teacher the following day if they struggle. The majority of children enjoy the challenge. They are not worried about bringing incomplete work to school if they can demonstrate that they have "had a go" .

Next steps:

- Give parents an insight into the resilient attitude that enables the children to succeed.
- Ensure that teachers make more explicit BLP links with homework so that pupils and teachers understand why certain tasks are set. Ensure that parents and pupils understand that it is good to make mistakes in mathematics as this supports challenge in learning.
- Further develop strategies to enable parents to support their children to "have a go" and learn from their mistakes.
- Continue to develop the MATHSZONE on the school website.

Professor Jo Boaler found that, "posing and extending problems of interest to students mean they enjoy mathematics more, they feel more ownership of their work and they ultimately learn more." Our pupils echoed this in pupil interviews. They want more real –life problems, opportunities to work at greater depth and to explore problems creatively and in context. This mirrored the response from parents and pupils and has given us a clear focus for the way forward.

Our children are resilient and resourceful and are leading our parents to an understanding of a growth mindset rather than the other way round. Future possibilities that we could explore might be the use of parent leaflets or videos to demonstrate methods. The children have suggested that they could make some PowerPoint presentations from the pupil perspective to support their learning at home. The survey of pupils found that they are not concerned about getting parental help at home and enjoy the struggle of complex maths task.

Widening the approach

I decided to share the focus with senior leadership colleagues and the Year 5 teacher. This enabled me to focus on both Key Stage 1 and Key Stage 2 pupils. It gave me the opportunity to reflect on the whole school experience of maths at our school. The Year 5 teacher was particularly interested in developing the language of the characteristics of learning with her class and, following some CPD at Wroxham School, devised an approach to learning feedback which she has trailed with her class.

Impact and recommendations

There has been a clear impact on the use of the language of learning in Year 5 where this process was trialled. In pupil interviews whilst there was no difference in the mindset demonstrated, it was the vocabulary used to articulate the characteristics of learning that was evident in those pupils. The children used the words, absorption, resilience, collaboration, and reasoning etc. A qualitative difference in responses.

Having shown that Building Learning Power principles are so well embedded that our pupils' resilience and their "have a go" attitude means they thrive even when there is a parental barrier to maths. Pupils are willing to have a go without parental support and will approach their teacher the following day if they struggle. Systems are in place and are clearly understood. Pupils bring in incomplete work or a series of questions to work on with their teacher.

To extend the Year 5 trial to allow parents more of an insight into the resilient attitude that enables our pupils to succeed. To educate our parents about the language of the characteristics of learning so that they can fully participate in the development of the BLP principles and development of their children.

It will be important to move forward with all teachers to being more explicit in making BLP links so that pupils, teachers and parents understand why tasks are set. We need to continue to support pupils and parents to develop their understanding of the impact of challenge within learning. To understand that it is ok to make mistakes and to develop our homework diet to ensure that parents have opportunities to support pupils to have a go and learn from their mistakes. We also need to provide more opportunities for peer evaluation to ensure that this takes place as frequently as in English lessons.

We continue to have a small group of pupils and parents for whom getting it right and test results remains the measure of success in maths. This group needs to be the focus of our attention next.

Recent Key Stage 2 test results reinforce our findings. BLP principles have enabled our pupils to achieve excellent results, significantly above the Hertfordshire and national level . Only 2 pupils did not achieve the expected standard in maths this year, both of which joined our school during Key Stage 2. Ten pupils achieved level 2b or below at the end of Year 2 and all of these children reached expected standards despite the increased expectations of the new curriculum. In terms of scaled scores, the class average was 107.9 (the national average was 103.6 and Hertfordshire was 103). The average for those pupils who were at level 2b or below in our Key Stage 1 was 104.9. Eight of these pupils achieved a standard score higher than the Hertfordshire average. Our pupils are resilient and didn’t give up when faced with challenging tests. They are able to use their learning power to overcome obstacles, be they maths anxiety, fixed mindset messages or a new curriculum.

Contact	Karen Briscoe, Maths Subject Leader
Reading and website references	School website: www.clitherow.herts.sch.uk Boaler, J. (2015). *Mathematical Mindsets: Unleashing Students' Potential Through Creative Math, Inspiring Messages and Innovative Teaching.* San Francisco, CA: Jossey-Bass. Beilock, L. S., Gunderson, E. A., Ramirez, G., & Levine, S. C. (2009). Female teachers' math anxiety affects girls' math achievement. *Proceedings of the National Academy of Sciences*, *107*(5), 1860–1863. Claxton, G. (2002) Building Learning Power; Helping Young People Become Better Learners Maryl Chambers, Graham Powell and Guy Claxton (2005) Building 101 Ways to Learning Power www.buildinglearningpower.com www.tloltd.co.uk

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